devices **100** and **500** so as to emit light having a wavelength different from the light generated by the semiconductor devices **100** and **500**. Accordingly, the emission of light may be controlled to have different colors including white light.

[0145] For example, in a case in which the semiconductor devices **100** and **500** emit blue light, white light may be emitted through a combination thereof with yellow, green, and red and/or orange phosphors. Also, the semiconductor devices **100** and **500** may be configured to include at least one LED chip emitting purple, blue, green, red, or infrared (IR) light. For example, the semiconductor device packages **1000** and **2000** may adjust a color rendering index (CRI) in a range from a level of light with a CRI of 40 to a level of light with a CRI of 100, and may generate various types of white light having a color temperature in a range of about 2,000K to 20,000K. Also, the color may be adjusted by generating visible purple, blue, green, red, orange light, or IR light, corresponding to a surrounding atmosphere or desired mood, as necessary. Also, light from within a desired, or alternatively predetermined wavelength known to stimulate plant growth may be generated.

[0146] White light generated by combining yellow, green, and red phosphors with a blue LED and/or combining at least one of a green LED and a red LED therewith may have two or more peak wavelengths, and may be positioned in a segment linking (x, y) coordinates of (0.4476, 0.4074), (0.3484, 0.3516), (0.3101, 0.3162), (0.3128, 0.3292), and (0.3333, 0.3333) in the CIE 1931 color space illustrated in FIG. **21**. Alternatively, the white light may be positioned in an area surrounded by the segment and a black body radiation spectrum. The color temperature of the white light may be in a range of 2,000K to 20,000K.

[0147] Phosphors applicable to the example embodiment may have a composition and a color as follows.

[0148] Oxide-based phosphors: yellow and green $Y_3Al_5O_{12}$:Ce, $Tb_3Al_5O_{12}$:Ce, $Lu_3Al_5O_{12}$:Ce

[0149] Silicate-based phosphors: yellow and green $(Ba, Sr)_2SiO_4$:Eu yellow and orange $(Ba, Sr)_3SiO_5$:Ce

[0150] Nitride-based phosphors: green β-SiAlON:Eu, yellow $La_3Si_6N_{11}$:Ce, orange α-SiAlON:Eu, red $CaAlSiN_3$:Eu, $Sr^2Si_5N_8$:Eu, $SrSiAl_4N_7$:Eu, $SrLiAl_3N_4$:Eu, Ln_4-x(EuzM$_1$-z)xSi$_{12}$-yAlyO$_3$+x+yN$_{18}$-x-y (0.5≤x≤3, 0<z<0.3, 0<y≤4), where Ln denotes an element selected from the group consisting of or including IIIA group elements and rare earth elements, and M denotes at least one element selected from the group consisting of or including calcium (Ca), barium (Ba), strontium (Sr), and magnesium (Mg).

[0151] Fluoride-based phosphors: KSF red K_2SiF_6:Mn^{4+}, K_2TiF_6:Mn^{4+}, $NaYF_4$:Mr^{40+}, $NaGdF_4$:Mn^{4+}.

[0152] In general, phosphor compositions need to conform to Stoichiometric requirements, and each element may be substituted with a different element within the same group in the perodic table of elements. For example, Sr may be substituted with Ba, Ca, Mg, or the like, in the alkaline earth metal group II while yttrium (Y) may be substituted with terbium (Tb), lutetium (Lu), scandium (Sc), gadolinium (Gd), or the like, in the lanthanide group. Also, europium (Eu), or the like, an activator, may be substituted with cerium (Ce), Tb, praseodymium (Pr), erbium (Er), ytterbium (Yb), or the like, based on a desired energy level. In addition, the activator may be used alone, or a co-activator, or the like, may be further included to change characteristics.

[0153] Further, a material such as a QD may be used as a phosphor substitute material, or the phosphor and the QD may be used in combination or alone.

[0154] The QD may have a structure including a core such as cadmium selenide (CdSe) and indium phosphide (InP) having a diameter of about 3 to 10 nanometers (nm), a shell such as zinc sulfide (ZnS) and zinc selenide (ZnSe) having a thickness of about 0.5 to 2 nm, and a ligand for stabilizing the core and the shell, and may provide various colors based on the size thereof.

[0155] FIGS. **22** and **23** are cross-sectional views illustrating examples of backlight units using semiconductor devices according to example embodiments.

[0156] Referring to FIG. **22**, a backlight unit **3000** may include a light source **3001** mounted on a substrate **3002**, and at least one optical sheet **3003** disposed thereabove. As the light source **3001**, the semiconductor device package having the structure described above with reference to FIGS. **19** and **20** or a same or similar structure thereto may be used, or a semiconductor device may be directly mounted on the substrate **3002** in a so-called COB type manner.

[0157] The light source **3001** in the back light unit **3000** illustrated in FIG. **22** may emit light upwardly in a direction in which a liquid crystal display (LCD) device is disposed. However, in a back light unit **4000** of another example illustrated in FIG. **23**, a light source **4001** mounted on a substrate **4002** may emit light in a lateral direction such that the emitted light may be incident onto a light guiding panel **4003** to be converted into a form of a surface light source. Light, having passed through the light guiding panel **4003**, may be dissipated upwardly, and a reflective layer **4004** may be disposed below the light guiding panel **4003** to improve light extraction efficiency.

[0158] FIGS. **24** and **25** are exploded perspective views illustrating examples of lighting apparatuses using semiconductor devices according to example embodiments.

[0159] Referring to FIG. **24**, a lighting apparatus **5000** is illustrated as a bulb-type lamp, and may include a light emitting module **5010**, a driving unit **5020**, and an external connection unit **5030**. In addition, the lighting apparatus **5000** may further include an outer structure such as an external housing **5040**, an internal housing **5050**, and a cover unit **5060**.

[0160] The light emitting module **5010** may include a semiconductor device **5011** having a structure identical to or similar to the semiconductor device **100** of FIG. **18** and a circuit substrate **5012** on which the semiconductor device **5011** is mounted. In the example embodiment, an example in which a single semiconductor device **5011** is mounted on the circuit, substrate **5012** is exemplified; however, as necessary, a plurality of semiconductor devices may be mounted thereon. Further, the semiconductor device **5011** may not be mounted directly on the circuit substrate **5012**, and may be mounted thereon subsequently to being manufactured in the package form illustrated in FIGS. **19** and **20**.

[0161] The external housing **5040** may serve as a heat dissipation unit, and may include a heat dissipation plate **5041** in direct contact with the light emitting module **5010** to enhance heat dissipation effects, and heat dissipation fins **5042** surrounding a side surface of the external housing **5040**. The cover unit **5060** may be mounted on the light emitting module **5010**, and may have a convex lens shape. The driving unit **5020** may be installed in the internal housing **5050**, and may be connected to the external con-